

## PATENT ABSTRACTS OF JAPAN

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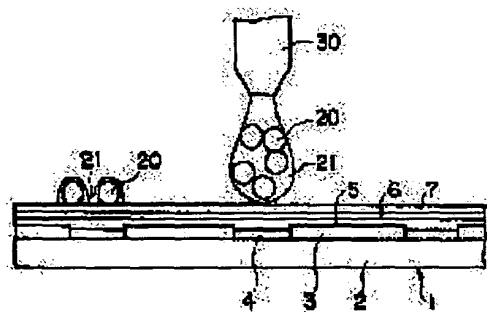
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## (54) LIQUID CRYSTAL DISPLAY ELEMENT AND ITS PRODUCTION

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To obtain a liquid crystal display element having the highest possible display grade by providing the production process with a stage for applying a liquid mixture composed of spacers for adjusting the spacing between two sheets of substrates formed respectively with oriented films and a resin by using an ink jet nozzle in the prescribed positions of at least one substrate of these substrates and a stage for curing the resin.

**SOLUTION:** The liquid mixture composed of the spacers 20 and the thermosetting type epoxy resin 21 which is an adhesive is applied by using the ink jet nozzle 30 in the desired regions on counter substrate 1 formed with the oriented film. The ink jet nozzle 30 is a piezoelectric type ink jet nozzle of 30 holes and the supply rate of this liquid mixture is 0.01ml/min. The coating application time is 5 seconds (in the case the size of the glass substrate 2 is 10.4 inches). In succession, the counter substrate 1 is heated for 10 minutes at 180° C to cure the resin 21. As a result, the liquid crystal display element with which the uniform spraying of the spacers 20 in the non-pixel regions without spraying in the pixel regions is possible and which has the excellent display grade is obtd.



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CLAIMS

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[Claim(s)]

[Claim 1] The manufacture method of the liquid crystal display element characterized by having the process which applies the mixed liquor of the spacer for using an ink-jet nozzle for the position on one [ at least ] substrate, and adjusting the gap between the aforementioned substrates to it between two substrates by which the orientation film was formed in each, and a resin, and the process which stiffens the aforementioned resin.

[Claim 2] The aforementioned resin is the manufacture method of the liquid crystal display element according to claim 1 characterized by being a thermosetting resin.

[Claim 3] The aforementioned resin is the manufacture method of the liquid crystal display element according to claim 1 characterized by being the resin of a photoresist.

[Claim 4] The manufacture method of the liquid crystal display element characterized by having used the ink-jet nozzle on one [ at least ] substrate between two substrates by which the electrode was formed in each, and having the process which applies the mixed liquor of the spacer for adjusting the gap between the aforementioned substrates, and an orientation film formation solution, and the process which stiffens the aforementioned orientation film formation solution.

[Claim 5] The liquid crystal display element characterized by having the orientation film material which was formed of the ink-jet nozzle on the principal plane of one [ at least ] substrate of the 1st and 2nd substrates by which the electrode was formed in each principal plane, and the above 1st and the 2nd substrate, and which the spacer for gap adjustment between substrates contained, and the liquid crystal layer pinched between the above 1st and the 2nd substrate.

[Claim 6] The aforementioned spacer is a liquid crystal display element according to claim 5 characterized by being arranged to the non-pixel field.

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to a liquid crystal display element and its manufacture method.

[0002]

[Description of the Prior Art] Generally, the liquid crystal display element has the composition that pinch a liquid crystal constituent between two transparent substrates by which the electrode was prepared in each, fix the circumference of two above-mentioned substrates with adhesives except for the liquid crystal inlet section, and the above-mentioned liquid crystal inlet section is closed with a sealing agent.

[0003] The light filter to which the liquid crystal display element for color displays becomes one substrate of the two above-mentioned substrates from the coloring layer of R (red), G (green), and B (blue) is formed among such liquid crystal display elements. For example, opposite arrangement of the signal-electrode substrate which has the signal electrode by which patterning was carried out to band-like in the electrochromatic display device of a simple matrix drive method, and the scanning electrode substrate which has a coloring layer the scanning electrode by which patterning was carried out to band-like, and under this scanning electrode is carried out so that the above-mentioned scanning electrode and a signal electrode may intersect perpendicularly, and it has become with the composition that the spacers for gap adjustment are scattered and a liquid crystal constituent is pinched among these substrates.

[0004] As liquid crystal, TN (twisted nematic) type, a STN (super-twisted nematic) type, GH (guest-host) type, an ECB (electrically controlled birefringence) type, or a ferroelectric liquid crystal is used. As a sealing agent, the adhesives of heat or ultraviolet-rays hardening type acrylic or an epoxy system are used.

[0005] Moreover, it sets for a color type active-matrix drive liquid crystal display element. For example, the array substrate in which the TFT (henceforth TFT) which used the amorphous silicon layer as the semiconductor layer, the pixel electrode connected to this TFT, the signal-line electrode, and the gate electrode were formed, The above-mentioned pixel electrode is equipped with the opposite substrate which has the counterelectrode by which opposite arrangement was carried out, a RGB light filter is formed in one substrate of an opposite substrate or an array substrate, and it has the composition that spacers were scattered and the liquid crystal constituent was pinched between these two substrates. And these two substrates are pinched with a polarizing plate, and it is displaying as a color picture, using this polarizing plate as an optical shutter.

[0006]

[Problem(s) to be Solved by the Invention] When manufacturing such a liquid crystal display element conventionally, it is the process which makes spacers scattered on a substrate, and a spacer is arranged unevenly or is sprinkled in many cases by even the pixel section. When the spacer had been arranged unevenly, a desired substrate gap was not obtained, but the uniform display was no longer obtained, and there was a problem that the yield fell. Moreover, when the spacer was sprinkled by even the pixel section, light leaked from the spacer periphery by disorder of the orientation of the spacer circumference, and there was a problem that a color lath fell. Although transposing to the black spacer as a cure against optical leakage was also performed, uniformity of spraying could not be made to have been able to cancel and a still uniform display was not able to be obtained.

[0007] this invention is made in consideration of the above-mentioned situation, and it aims at display grace offering a high liquid crystal display element and its manufacture method as much as possible.

[0008]

[Means for Solving the Problem] The 1st mode of the manufacture method of the liquid crystal display element by this invention is characterized by having the process which applies the mixed liquor of the spacer for using an ink-jet nozzle for the position on one [ at least ] substrate, and adjusting the gap between the aforementioned substrates to it

between two substrates by which the orientation film was formed in each, and a resin, and the process which stiffens the aforementioned resin.

[0009] Moreover, the 2nd mode of the manufacture method of the liquid crystal display element by this invention is characterized by the aforementioned resin being a thermosetting resin in the manufacture method of the 1st mode.

[0010] Moreover, the 3rd mode of the manufacture method of the liquid crystal display element by this invention is characterized by the aforementioned resin being a resin of a photoresist in the manufacture method of the 1st mode.

[0011] Moreover, the 4th mode of the manufacture method of the liquid crystal display element by this invention is characterized by having used the ink-jet nozzle on one [ at least ] substrate between two substrates by which the electrode was formed in each, and having the process which applies the mixed liquor of the spacer for adjusting the gap between the aforementioned substrates, and an orientation film formation solution, and the process which stiffens the aforementioned orientation film formation solution.

[0012] The 1st and 2nd substrates by which, as for the 1st mode of the liquid crystal display element by this invention, the electrode was formed in each principal plane, It is characterized by having the orientation film material which was formed of the ink-jet nozzle on the principal plane of one [ at least ] substrate of the above 1st and the 2nd substrate and which the spacer for gap adjustment between substrates contained, and the liquid crystal layer pinched between the above 1st and the 2nd substrate.

[0013] Moreover, the 2nd mode of the liquid crystal display element by this invention is characterized by arranging the aforementioned spacer to the non-pixel field in the liquid crystal display element of the 1st mode.

[0014]

[Embodiments of the Invention] The gestalt of 1 implementation of the manufacture method of the liquid crystal display element by this invention is explained with reference to drawing 1 and drawing 2. Drawing 1 is the manufacturing process cross section of the manufacture method of the gestalt of this operation, and drawing 2 is the composition cross section of the liquid crystal display element manufactured by the manufacture method of the gestalt this operation.

[0015] After forming first TFT (it says Following TFT) 13 and the pixel electrode 14 which consist of an amorphous silicon on a glass substrate 12, such TFT13 and the pixel electrode 14 are covered by the orientation film 15 which consists of a polyimide, and the array substrate 11 is formed in this orientation film 15 by carrying out rubbing processing.

[0016] Next, as shown in drawing 2, the coloring layer 3 which has arranged three colors of R.G.B in order is formed in the position corresponding to the pixel electrode 14 of the array substrate 11 on a glass substrate 2, and the shading film 4 is formed in the circumference of this coloring layer 3. And the coloring layer 3 and the shading film 4 are covered with a protective layer 5. Next, the counterelectrode 6 which consists of ITO (Indium Tin Oxide) is formed on this protective layer 5, the orientation film 7 which consists of a polyimide is formed on this counterelectrode 6, and rubbing processing is performed to this orientation film 7. It carries out by the well-known manufacture method so far.

[0017] Next, as shown in drawing 1, the mixed liquor of a spacer 20 (for example, micro pearl (the Sekisui fine-chemicals company make)) and the heat-hardened type epoxy resin 21 used as adhesives is applied to the field (field corresponding to the shading film 4 top) of the request on the opposite substrate 1 in which the orientation film 7 was formed as mentioned above using the ink-jet nozzle 30. The ink-jet nozzle 30 is a piezo formula ink-jet nozzle of 30 holes, the amount of supply of the above-mentioned mixed liquor is 0.01 ml/min, and application time is 5 seconds (when the size of a glass substrate 2 is 10.4 inches). Then, the opposite substrate 1 is heated for 10 minutes at 180 degrees C, and a resin 21 is stiffened. In addition, the viscosity of mixed liquor of the viscosity of the used resin 21 was 10cp(s) in 7cp(s).

[0018] Next, as shown in drawing 2, while printing adhesives 22 except for a liquid crystal inlet (not shown) along the circumference of the orientation film 15 on the array substrate 11, the transition electrode (not shown) for impressing voltage to the opposite substrate 1 from the array substrate 11 is formed around the above-mentioned adhesives 22.

[0019] And the orientation film 7 on the opposite substrate 1 and the orientation film 15 of the array substrate 11 counter, namely, while the principal plane of the opposite substrate 1 and the principal plane of the array substrate 11 counter, by arranging and heating substrates 1 and 11 so that each direction of rubbing may intersect perpendicularly, adhesives 22 are stiffened and it sticks.

[0020] Next, by the well-known method, after pouring in the liquid crystal constituent 24 from the above-mentioned inlet, the above-mentioned inlet is closed using ultraviolet-rays hardening resin, and a liquid crystal display element is completed by sticking polarizing plates 25a and 25b on the outside of the opposite substrate 1 and the array substrate 11.

[0021] In the manufacture method of the form this operation, without sprinkling a spacer 20 to a pixel field, since spraying of the spacer 20 to a substrate top is performed by using for a desired position the ink-jet nozzle 30 which can

be applied, and applying mixed liquor with adhesives, it becomes possible to sprinkle uniformly to a non-pixel field, and the liquid crystal display element which was excellent in display grace can be obtained.

[0022] Next, the form of implementation of the 2nd of the manufacture method of the liquid crystal display element by this invention is explained. The manufacture method of the form this 2nd operation uses an optical hardening type acrylic denaturation epoxy resin instead of the heat-hardened type epoxy resin 21 in the form of the 1st operation. And after applying the mixed liquor of this optical hardening type acrylic denaturation epoxy resin and spacer 20 to the field on the shading film 4 of the opposite substrate 1 using the ink-jet nozzle 30, it carries out like the form of the 1st operation except stiffening a resin by irradiating light through the mask which lets light pass by the pattern corresponding to the shading film 4.

[0023] Doing so the same effect as the form of implementation of the manufacture method 1st of the form of this 2nd operation cannot be overemphasized.

[0024] In addition, in the manufacture method of the form the above 1st and the 2nd implementation, although the mixed liquor with the resin 21 used as a spacer 20 and adhesives was applied on the opposite substrate 1, you may apply to the array substrate 11 side. In this case, as for the adhesives 22 for sticking the opposite substrate 1 and the array substrate 11, being printed at the opposite substrate 1 side is common.

[0025] In addition, in the manufacture method of the form the above-mentioned implementation, although rubbing of a combination film was performed before the application of mixed liquor, you may perform it after hardening of a resin 21.

[0026] In addition, although the mixed liquor with the resin 21 which serves as a spacer 20 and adhesives in the manufacture method of the form the above-mentioned implementation was applied to one substrate of the opposite substrate 1 and the array substrates 11, after applying on both substrates and making it harden as shown in drawing 3 (a), you may stick a substrate 1 and a substrate 11 so that these spacers 20 may touch, as shown in drawing 3 (b). Thus, if this arrangement is performed before rubbing processing of an orientation film when arranging a spacer 20 to both substrates, the field by which rubbing is not carried out serves as smallness, and better display grace can be obtained. Moreover, let particle size of a spacer be the half of the particle size of the spacer in the case of arranging only to the substrate of one side, as shown in drawing 2 in this case.

[0027] In addition, in the manufacture method of the gestalt the above-mentioned implementation, although the spacer 20 was applied with the resin 21 on the substrate in which the orientation film 7 was formed, the ink-jet nozzle 30 may be used on the substrate in which the orientation film is not formed, and the orientation film with which the mixed liquor of a spacer 20 and an orientation film formation solution was applied, and the spacer 20 was applied by carrying out heating baking may be fabricated. In addition, an orientation film formation solution melts orientation film material (tradename (Japan Synthetic Rubber Co., Ltd. make)), AL-1051 [ for example, ], with a solvent, for example, gamma-butyl lactone. In this case, although the application of mixed liquor is applied to a non-pixel field, for a low reason, an orientation film formation solution flows [ the viscosity of an orientation film formation solution ] also on a pixel field, and an orientation film is formed also on a pixel field.

[0028] Moreover, in the manufacture method of the 1st gestalt the above-mentioned implementation, you may use the above-mentioned orientation film formation solution instead of a heat-curing epoxy resin. In this case, melting of the orientation film front face in which the solvent was already formed is carried out at the time of the application of spacer mixed liquor, and it becomes possible by [ the ] carrying out a postcure to make an orientation film fix SUHESA more firmly.

[0029] In addition, in the manufacture method of the gestalt the above-mentioned implementation, although explained taking the case of the acouchi boomer tris type liquid crystal display element, this invention is not restricted to this.

[0030]

[Effect of the Invention] As stated above, according to this invention, display grace can be made high as much as possible.

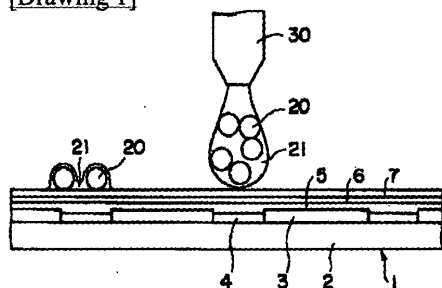
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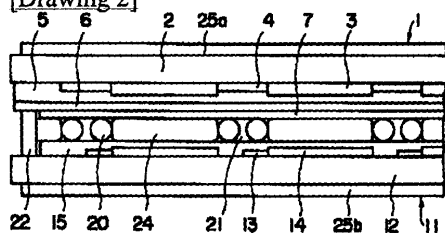
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DRAWINGS

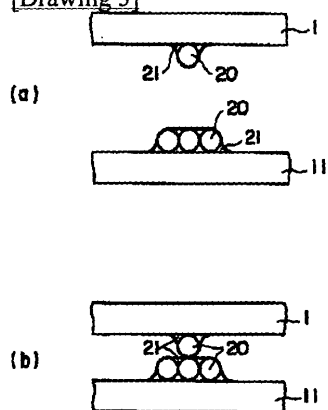
[Drawing 1]



[Drawing 2]



[Drawing 3]



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